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WIDEST SENSE

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(BY PERMISSION OF THE CHIEF OF THE U. S. WEATHER BUREAU)

AMERICAN JOURNAL
OF
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THOS. H. McCOLLIN, Managing Editor.

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VOL. XVII. NOVEMBER, 1896. No. 203.

TRACING THE PATH OF A FLASH OF LIGHTNING BY PHOTOGRAPHY.*

ALEXANDER McADIE.

WHAT follows is a brief account of an attempt made in the summer of 1895, at Washington, by myself and associates, Messrs. A. J. Henry, F. W. Randolph and A. S. Potter, all of the Weather Bureau, to photograph *simultaneously*, from several points, a flash of lightning.

Probably all of the readers of this JOURNAL know that there is a large element of chance in photographing lightning. I believe it is possible to tell by certain apparatus *when* it is going to lighten, but just exactly *where* the path of discharge will be is another matter. In the large collection of photographs of lightning and electric phenomena of the atmosphere, in my possession, I know of some excellent lightning photographs which were obtained when the photographer had little reason to claim credit for getting them. It has been my experience to leave a camera and an exposed plate in one of the rooms of an observatory and going outside to watch something else for a few minutes, observe a magnifieent discharge, and return and find it on my plate upon developing, although convinced that I was wasting a plate. On the other hand, with all care and preparation, we have failed to

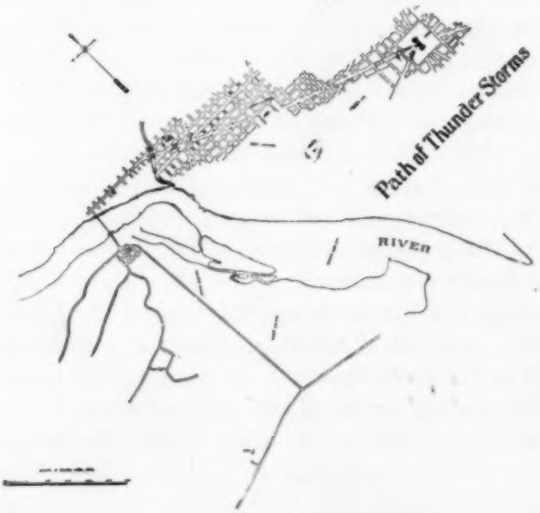
* By permission of the Chief of the U.S. Weather Bureau.

capture flashes with the camera. In this particular experiment, which lasted throughout a summer, luck was decidedly against us. The thunder-storms, ordinarily frequent, did not occur as in other summers, and the few flashes which we could have best used came outside of the hours of observation. The experiment demonstrated the feasibility of the scheme, however, and it only remains for some one to repeat it with more successful results.

Lightning flashes in a single plane have been obtained in great number. In Bulletin 15, U. S. Weather Bureau, there are numerous illustrations showing the different types of lightning discharge. For example, the multiple flash, the destructive flash, the cloud splash, the impulsive rush discharge, the meandering flash, etc. It is very evident that a flash of lightning is not generally a straight line. The statement that lightning always follows the path of least resistance, which is quite frequently made, is not, as commonly understood and stated, true. Ohmic resistance does not determine the path. Without stopping to go into a discussion of the problem from its electrical side, it is enough to say that when the air is subjected to a strain, whether steady or intermittent, by a highly charged cloud and an oppositely charged earth surface, at a certain limit there will be a breakdown, and it is this breakdown that we wish to study by means of several cameras and simultaneous photographs. It is as if we had a piece of tremendously thick plate glass and were going to crack it. Given three cameras ranged around the line of fracture, can we get a composite picture from which we could make a model of the crack, showing all the little deviations in all directions?

A flash of lightning has some points of interest not generally thought of by the ordinary beholder. In one of the illustrations herewith a horizontal flash will be noticed which changed direction not less than four times. A flash rapidly approaching or receding will be out of focus in different places, and it may actually come back again into focus. The little beads and knobs seen on so many flashes are probably places where the flash changes direction. To investigate, then, the peculiarities of lightning discharges we planned this experiment. Three cameras were aligned upon the apex of the Washington monument. The edi-

fice is 555 feet high, and makes a prominent feature in the landscape. The diagram shows the disposition of our cameras. The observer at the capitol was 7500 feet east; the observer at Arlington, across the Potomac river, 16,500 feet away to the southwest; and the observer at the Weather Bureau, 7250 feet distant to the northwest. We thus had the monument under photographic surveillance from all points of the compass. Whenever, between the hours of 7.30 and 10.30 p.m., a thunder-storm was expected, the observers were at their posts, exposed their plates and waited patiently. As we have said above, there were



very few flashes that summer in close proximity to the monument, and the few that did occur were feeble in character. Our photographs showed, however, that to the southeast over the water and lowlands, beyond the District line and on into Maryland, the majority of the flashes occurred. In fact, the path of the thunder squalls was marked out by the lines of lightning discharge. Some flashes, about half a mile southeast of the monument, came within our field of work, and we obtained simultaneous photographs of them, although a little distorted. Change in direction was clearly shown, and with a piece of stiffly waxed string we

subsequently made a rough model of one of the flashes, showing how it started to come to earth in one direction and then changed. The exact location of the flash was determined by the intersecting lines and each change of direction by the appropriate photograph in that plane.

By the close of the thunder-storm season it became apparent that we were working under abnormal conditions. There were many people in Washington who thought they saw flashes close to the monument, but as we had photographs of the flashes identifying them by the time, we knew that in reality the flashes, while in line with the monument, were far to the southeast.

It has always seemed to me that before we can offer adequate protection against lightning, we must measure the flashes and know something of their dimensions and energy. It is only wise to attempt to harness when you know how strong the object to be harnessed is. We can measure directly the work done by lightning infusing metals or breaking wood and masonry, or, as we have suggested, by photographically determining the dimensions of the flash, and working out, as Dr. Lodge has done, the electrical energy of a flash of such dimensions.

I may mention that on comparing the width of one of the flashes with an object of known dimensions close by, we made the width of the lightning streak certainly not less than ten feet. But as the intensity of the light will determine largely the impression on the plate, it will not do to say that the flash was ten feet wide.

Whenever a duty is shirked, there Christ is rejected. Whenever we act knowingly and deliberately as we know that Christ would not have acted had He been in our circumstances, then we proclaim our disbelief in Him. And whenever we refuse to try to remedy wrongs which degrade our brother or our sister and render it impossible for them to lead a divine or even a decently human life, there also we deny Him, and crucify Him again in the person of the least of these His brethren.—*W. T. Stead.*

A QUESTION OF THE DAY.

Tagesfrage *Das atelier des Photographen.* Translated by Julius F. Sachse.

THE well-contested argument, as to how far the process of fixing the photographic image must be carried on in a subdued or non-actinic (red) light, is as yet an unsettled problem. In most operating rooms the opinion prevails that the plate must not be exposed to the light until it is thoroughly fixed. The fixing trays are kept in the dark-room, and are provided with card-board, or wooden covers, so as to exclude any white light from the plates in the event of the door being opened.

On the contrary, it is hotly contended that a developed plate may be exposed with impunity to white light without danger, provided only that it has been sufficiently washed after development, or, in other words, that no trace of developer remains in the film. To practically decide this problem, a number of experiments were made with both bromide paper and ordinary dry plates. The result showed that it was best under all circumstances to fix plates or paper by the exclusion of all actinic light.

If an exposed plate, after development and a subsequent careful washing in acidulated and clear water, be cut in two, one part being placed in a tray of water in the dark-room, the other in a similar tray exposed to daylight, both parts being afterwards placed in the hypo at the same moment, a marked peculiarity manifests itself. The part which had been kept in the dark-room was fixed much more rapidly than the one exposed to the light.

The same was the case where one part was at once fixed in the dark, and the other in the light [without any previous exposure to light under water.—*Trans.*]. In this latter experiment both parts occasionally appear alike. Frequently, however, the exposed half appears somewhat denser. Secondly, when both parts, after fixing and a thorough washing are exposed to a strong light, no effect seems noticeable, both being equally permanent.

The above facts would seem to indicate that if the developer has been thoroughly eliminated from the film, an exposure to

actinic light has no bad effect upon an unfixed plate, except that it retards the process of fixing. It is naturally to be understood that the exposure to the light was not a prolonged one.*

Far different, however, is the case where the plates were not properly washed after development, In such experiments where an alkaline developer (rodinal) was used, then slightly washed and cut in half, one part was exposed to light, not long enough, however, to permit any remaining traces of the developing agent to continue its action. The action of this part when placed in the hypo bath was peculiar :

(1) The fixing process was prolonged abnormally.

(2) The plate was not entirely fixed.

(3) It was covered with an intense yellow stain.

This stain, or yellow fog, as the Germans call it, also appeared on bromide paper. Whenever a print on bromide paper, slightly washed after an alkaline development, was fixed in the light, yellow whites were the invariable result. Another peculiarity of the plates and papers thus treated is, that they cannot be intensified with the ordinary mercurial process, nor are they permanent if thus treated. Even after hours of fixing and careful working the action of the mercurial bath was an uneven one, and with the subsequent reduction (presumably ammonia) a dense yellow stain was the result. The permanency of the plate had also suffered, as by exposure of both plates and paper to the light the yellow stain gradually changed into a brown.

Far less marked were these conditions where a ferrous-oxalate developer was used. Here one may expose the plate to light with far more impunity, nor is it necessary to be so careful about washing out the developer, for fear of producing bad results. But the permanency of bromide papers thus treated was always more or less impaired so far as the whites were concerned, which within one to two weeks became yellow, and, strange to say, irregularly in different parts of the picture.

As it has been frequently advised that, when upon a journey, or in a position where water for washing is not available, it is

* The above experiments evidently were made with a ferrous-oxalate developer. —*Translater.*

but necessary that plates should be developed and treated with a solution of potassic bro nide and dried, and could thus be kept for an indefinite time and fixed in the future, the same course was pursued as in the previous experiments. Plates developed with both ferrous-oxalate and rodinal were cut in half, the one part immediately fixed, the other washed and laid in the following bath :

Bromide potassium, - - - - -	3 grs.
Water, - - - - - - -	50 ccm.
Citric acid, - - - - - -	3 grs.

After a bath of ten minutes the plates were placed upon a rack and dried in the light. These plates remained exposed to the ordinary light of the room for twenty-four hours, and then placed in the hypo. The result showed that the plates developed with ferrous-oxalate fixed properly with a faint yellow stain, while those upon which rodinal was used could not be fixed properly. They showed an intense yellow stain, and could not be intensified with the usual bichloride solution.

No better results were obtained where a weak, acidulated solution of bromide was used in place of the above formula.

From the above experiments it will be adduced that fixation must be completed in the dark, especially when an alkaline developer is used. Further, that, as a matter of fact, light exercises a harmful influence upon the unfixed plate. Where this effect now and then is not so noticeable, it will be found that the yellow stain, or fading of the image of an intensified plate, was erroneously charged to some other cause than the real one. Even the subjection of a partly fixed plate to daylight for purpose of examination is unadvisable.

Make yourselves nests of pleasant thoughts. None of us know, for none of us have been taught in youth, what fairy palaces we may build of beautiful thoughts—proof against all adversity. Bright fancies, satisfied memories, noble histories, faithful sayings, treasure-houses of precious and restful thoughts, which care cannot disturb, nor pain make gloomy, nor poverty take away from us—houses built without hands, for our souls to live in.—*John Ruskin.*

EXPERIMENTS WITH DIAPHRAGMS FOR HALF-TONE WORK.

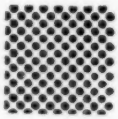
IN the face of the great interest which is at present taken in the formation of the dot in half-tone work, the following notes by T. J. Placezsk of some experiments undertaken at the suggestion of Dr. Eder, and reported in the current issue of the *Photographische Correspondenz*, will throw some light on the subject.

Although the high perfection of half-tone work is usually ascribed to the excellent cross-lined screens which have been placed on the market, of the best quality, still every one who works the half tone process knows, only too well, what an important part in the preparation of half-tone negatives the size as well as the shape of the diaphragm plays, and that only with intelligent use of the same can a good result be hoped for.

Whether the square or the round diaphragm is better can be easily determined.

Fig. 1.

Fig. 2.



It is, indeed, possible with diaphragms of correct size to obtain good results with the round as with the square. An easier coalescence of the dots in the high lights is undoubtedly obtained with the square stop, as the corners of the square dots thus formed produce a quicker closing up of the same.*

The transparent dots in the lights are also, when a square stop is used, much larger without a network being formed in the lights, which can easily be proved by a comparison of figs. 1 and 2.

* In order to avoid any misunderstanding in interpreting the figures in this article, let me at once state that the whole of the dots correspond to about a sixteen times enlargement of the original screen negatives, so that the black dots of the diagrams correspond to the covered parts of the negatives. The diaphragms given with the enlargements correspond to those with which the dots were obtained, and are about one-fifth their natural size.

Fig. 2 shows the formation of the dot with a round stop which is more favorable to the formation of a network.

As however larger dots can be sharpened in the lights by longer etching as the result of which the block may be etched deeper, and such blocks also print better, which also speaks favorably for the square stop. Therefore the advantage ought, as a rule, to lie with the square diaphragm. Still better acts the stop when the sides of the square aperture are slightly rounded towards the middle (fig. 3).

If a negative is examined which is made with an exact square stop (fig. 1), it will be found that the transparent dots are almost square; the best form of dot, however, is that in which the transparent dots in the lights approach the circular form, which may be fairly well obtained with the diaphragm (fig. 3).

Fig. 3.

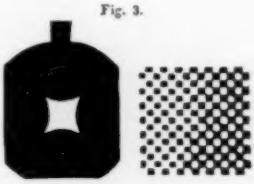
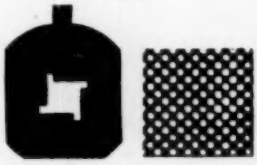


Fig. 4



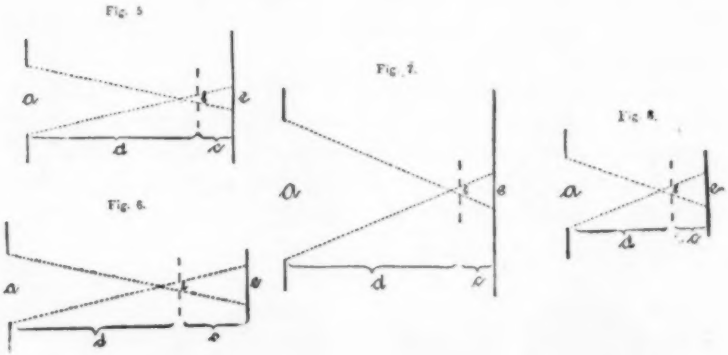
Levy's square stops with cut-out corners (fig. 4) are also very much liked. These also give rounded transparent dots in the lights, without which the formation of a network would easily appear. The points are similar to those produced with stop (fig. 3).

The theory of half-tone work has already been thoroughly investigated by Dr. J. M. Eder, and I shall refer to this. To better understand the following, I will just mention the principal rules of the half-tone process.

As is well known, the screen dot is the product of a pinhole camera, since the transparent openings of the screen act like a series of many pinhole cameras lying close to one another. The formation of the dot on the sensitive plate is dependent, besides the diaphragm aperture, on the distance of the sensitive plate from the screen, on the one hand, and to the optical centre (diaphragm slot of the lens), on the other.

Moreover, to explain these phenomena, let us consider the formation of the dot as normal in fig. 5.

In figs. 5–8, *a* denotes the diaphragm aperture; *b*, the aperture of a transparent screen hole; *c*, the distance of the sensitive plate from the screen; *d*, the distance of the screen from the optical centre; *e*, the dot formed on the sensitive plate.



If the distance, *c*, is increased (fig. 6) the dot *e* will become larger, which, however, can also be attained by a larger stop (fig. 7), or by a shorter-focus objective (fig. 8).

Small dots are therefore formed if small stops, a shorter screen distance, or a lens with long focus, be used.

The small diaphragms give, as I have mentioned above, small black dots in the negative.

Since the shadows ought only to be formed in the negative by small dots, small stops are only suitable for the shadows, which are well delineated.

In the lights, however, the dots are too small; the same stop which will give good worked-out shadows gives flat lights. There is formed over the whole of the picture a network which makes the negative useless.

As is shown in fig. 7, large stops give larger dots; if therefore one exposes with large stops, the dots in the lights will be good, but in the shadows there will be places free from dots.

If the exposure be so prolonged that the shadows also showed

dots, the lights as a rule would be closed up too much, and the fine dots in the negative in the subsequent transference to metal can only be etched with difficulty, or not at all.

A very small stop is therefore of as little use by itself as a very large one; with medium-sized stops it is possible, with suitable method of working, to obtain useful negatives with one exposure. If an exposure is made first with the small and then with the large stop, the shadows as well as the lights will be well worked through with greater certainty. Since the rapidity of the lens becomes considerably less when using small stops according to the formula $\left(\frac{d}{F}\right)^2 : \left(\frac{d'}{F'}\right)^2$†, it is actually quite logical that the exposure should be longer, and, as a rule, the small stop requires two-thirds of the whole time of exposure, whilst one-third is devoted to the large stop.

If there are very deep blacks in the original, an exposure should be made with a very small stop on a sheet of white paper, by which means the shadows are cleared up and will not be so clogged in printing.

It might be thought from the above that the half-tones would not be well represented; this, however, is not the case, since the large stops work on the shadows and the small stops on the lights, and therefore by the combination of the two actions the half-tones obtain their full value. It is therefore much easier to attain good results by changing the diaphragm during the exposure than with one stop and one exposure.

In a recent book on the half-tone process ‡ formulæ have been recommended for practice which give the correct size of diaphragms. By the aid of these diaphragms with carefully reckoned sizes, a change of diaphragm is almost always unnecessary, since these diaphragms give well-worked-out shadows and lights.§

Although theoretically the fact is perfectly correct, it will be,

§ The size of the diaphragms can be calculated from the formula $a = \frac{c+d.\,b}{c}$ (fig. 5).

† d=diaphragm aperture; F=the focus of lens.

‡ The Halbton process, by Julius Verfasser, translated by Dr. G. Aarland.

since the size of the diaphragm has to be reckoned out for every exposure, difficult to carry out in practice on account of want o time.

If the measurements of the transparent places in the screen, the distance of the sensitive plate from the screen as well as from the optical centre of the lens, are not accurately carried out, great errors will arise, which will not give the expected results.

With calculations accurately performed, dots in the high lights coalescing, and small dots in the shadows will be obtained.

Even if everything is satisfactory, unfortunately half-tone negatives which have been prepared with one diaphragm give frequently pictures wanting in detail, which are poor in the

Fig. 9.

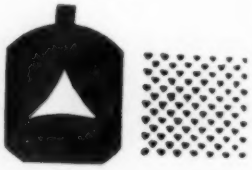


Fig. 10.

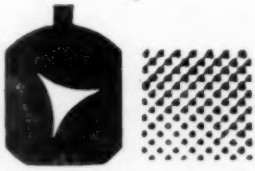


Fig. 11.

half-tones, a fact of which I have been convinced for a long time.

If the dots are not satisfactory when a negative is prepared by changing the diaphragm the negative can still be corrected. With these corrections the half-tone negative is very convenient to work with. It is not necessary to take much care of the shadows, but more of the lights and the dots should just touch ; still, if the dots in the lights do not quite touch, so that a faint network is noticeable, it is possible to make the dots touch by the lead intensifier, which builds up a dense deposit.

By reduction the dots which are too large in the shadows can be sharpened up without the lights becoming more open.

By various intensifiers it is possible to obtain the lights more open or more closed, as may be desired.

With the mercurial intensifier the dots are least, with the lead intensifier most, spread out. Between the mercury and lead intensifier stands the copper intensifier, with which, as a rule, success will be attained.

The best form of diaphragm is, as mentioned above, the square. The position of the diaphragm opening must be such that the side of the square crosses the diagonal screen lines.

The size of these stops is, for preliminary exposure, from *f*-40 to *f*-50;* for the shadows, *f*-15 to *f*-20: and, for the lights, *f*-12 to *f*-15.

For the large stop, *f*-12 to *f*-15, Levy's stop (fig. 4), or a square stop, which has only two opposite corners cut out, should be used.

If the above fundamental principles are relied upon for practice, it will be easy to immediately obviate any fault that may be formed.

The formation of the dots is easy to regulate. If the requisite care is taken in working, larger or smaller dots may be obtained without trouble, as the original or easy etching may require.

It is interesting that the dots approximately assume the shape of the diaphragms.† With double perforation of the diaphragm, in many cases there is obtained, instead of one point, two.

This process, with irregular or with several apertured diaphragms, Count V. Turati, of Milan, has specially worked out.‡

In the experiments here detailed, a Voigtländer euryscope of 86 cm. focus, and a Levy's cross-lined screen of forty-seven to fifty-four lines to the cm. were used.

The distance of the screen from the sensitive plate was fixed, comprising the thickness of the glass of the screen and the closest possible approach to the sensitive plate.

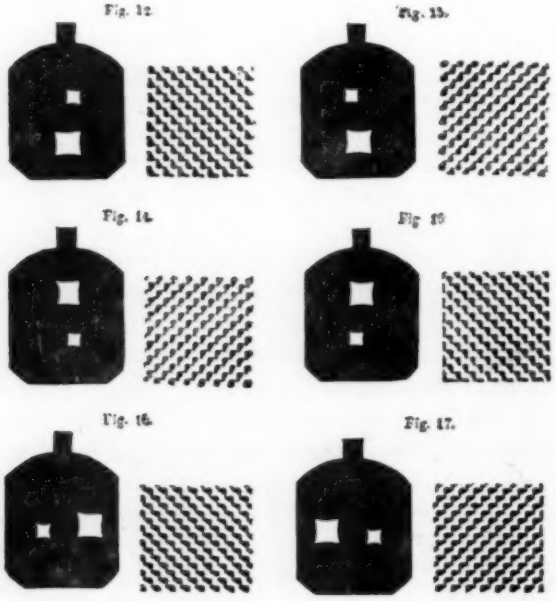
* That is to say, the length of the side of the square in proportion to the focus.

† The original form of the dots is considerably altered by intensification or reduction.

‡ Eder's *Jahrbuch*, 1896. *Photographische Mittheilungen*, 1896.

If diaphragms with triangular apertures in various directions are used (figs. 10 and 11), the dots will also show as small triangles, which are slightly differently arranged, according to the position of the triangle.

Very beautiful results were obtained with diaphragm (fig. 11). There were formed between four dots a small dot, which was wanting in the deepest shadows, but appeared in the half-tone and high lights.

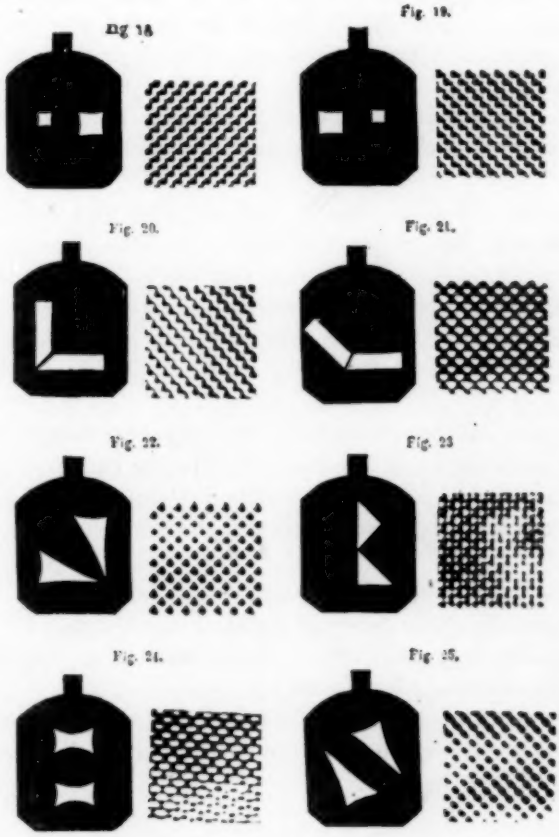


The same effect is obtained with this diaphragm as with a screen of double the fineness. The action is exactly similar to Levy's triple-line screen.

Fine screens cannot be used if, as fig. 11*a* shows, the dot formation is striven for, since these fine dots will not stand etching. On the other hand, the results obtained with coarse screens are equal to those obtained with fine, and therefore much dearer, screens.

It is, however, not so easy to obtain the small dot (fig. 11*a*) exactly in the middle, and this must be determined by experiment.

If the distance of the ground glass from the optical centre of



the lens is altered, two things may happen: the small dots may move up or down, coalesce with the large dots, and a pear-shaped dot (fig. 11*b*) is formed, which has its point directed either up or down. This may be also obtained if the centres of the two apertures are approximated or moved further apart.

With double perforated diaphragms, therefore, the dots may be made closer or farther apart, and thus the most different results attained. If the position of the two aperture centres are altered, so that the line which joins them to the centre of the aperture of the screen is made nearer without becoming parallel, various zigzag lines are formed. In figs. 12 to 19 the position of the dots is seen which can be attained by one diaphragm, but in different positions.

Other diaphragms' shapes and their effects in the preparation of half-toned negatives with cross-lined screens are shown in figs. 20 to 25.

As to the practical value of such diaphragms, I believe that they are, with the exception of fig. 11, of little importance for ordinary mono-chrome printing, but for half-tone three-color printing they can be of great use, since, *without altering the position of the screen or the original, by simply changing the diaphragm shape, the position and the shape of the dot can be altered for any color.*

How easily the position of the dots may be changed by the diaphragm is shown in figs. 12 to 19. If one considers that by other diaphragm apertures other dots may also be formed, it will be easily grasped how useful these diaphragms may be for color printing.

To the double perforated diaphragms belong, therefore, a complete knowledge of the theory of half-tone work, how, with safety and certainty, to obtain, with any enlargement, a reduction of the previously described shapes of dots.

If time and opportunity permit, further experiments will be instituted to study the use of stops for color printing, and the best form of dots for the same.

Such help as we can give each other in this world is a debt to each other; and the man who perceives a superiority or a capacity in a subordinate, and neither confesses nor assists it, is not merely the withholder of kindness, but the committer of injury.—*Ruskin.*

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SOME PRACTICAL POINTS IN SLIDE MAKING.

BY G. E. BROWN, F.C.S.

Which is the Film Side?—With the very thin plates that most makers give us now it is often difficult to tell which is the film side, and it is not always safe to rely on the uniformity of the method of packing. I remember seeing the following test given, and always use it when uncertain:—Breathe gently on the plate. The glass side will at once show a dimness over its surface. No difference will be noticeable if film side is uppermost.

A Good and Simple Lantern Slide Printing Frame.—Sufficient attention is not paid to the printing frame in making contact slides. No light should find its way to the edge of the plate, or it may cause a slight fog over the slide. I have found the following simple frame (due to M. Frank La Manna) invaluable. Take a 5 by 4 printing frame, remove the four triangular pieces which keep the negative in position and insert instead at each end of frame a piece of wood, just over 4 inches long and of square section, sufficiently large to be flush with the other sides of the frame. Now fit a piece of ¼-inch wood tightly into the frame and cut in it an exactly central aperture 3 inches square. Ensure the sides and ends of this aperture being parallel to the edges of the whole piece. Now paste down a piece of velvet or plush without, of course, covering the aperture. Next cut a piece of thin cardboard or millboard so that it will fit into the frame with a very slight amount of play, and having an exactly central aperture a shade over 3¼ inches square. Now cut a wood back to the frame of same size as cardboard, and glue centrally a 3-inch square of black velvet. To use the frame:—Remove back and millboard, place negative face up on the velvet, so that the portion desired on slide appears over the aperture, lay down the millboard, place the lantern plate in aperture in millboard and insert back. Advantages:—Certainty of portion of negative on slide; edges of plate protected from light; always an edging of unexposed film on plate with which high lights of slide can be compared.

A Good Developer.—Make two solutions:

A. Hydroquinone	- - - -	80 grains
Soda sulphite	- - - -	1 ounce
Potass. bromide	- - - -	15 grains
Water to	- - - - -	10 ounces
B. Caustic potash	- - - -	50 grains
Water to	- - - - -	10 ounces

Mix A. and B. in equal parts, flow over plate and rock gently till detail just appears. Then, without washing plate, place in bath consisting of 1 part Solution B. to 3 parts of water. Slide now grows rapidly in detail without getting too dense. Advantages:—Pleasant sepia tone; more detail; more transparent shadows.

The Right way to Apply Farmer's Reducers.—In making slides of black-and-white subjects, such as woodcuts from books, it is best to over-develop and afterwards reduce in daylight, when density can be judged to a nicety. When using the reducer do not immerse the plate in it. Mix the reducer in a cup and apply it to the plate with a tuft of cotton wool. Do not keep the cotton wool too wet. It is surprising how much surface fog the reducer will clear off without weakening the image, if the solution is not allowed to penetrate the film. Avoid keeping the reducer too long on the plate at one time. This causes stains. Frequent flooding with water prevents them. The use of Farmer's reducer is out of the question for slides from half-tone negatives. It ruins their graduation and often their tone.

Clearing Solution. Most slides are improved by a clearing bath. After well washing from hypo use a solution of common salt, to which a little nitric acid has been added (as suggested by Bolton). This will clear any fog or veil from a slide much more effectually than the usual alum or iron mixtures.

How to Render Ice in Slides.—Make a slide of a purple or red tone, either on a print-out plate or by over-exposure and restrained development. Then tone this in a sulphocyanide and gold toning bath. You will find that the high lights—the ice—will tone more quickly than the rest, and, by regulating the strength of bath, you can obtain the ice of a most appropriate

bluish tone, whilst the rest of the subject is black or even brown. Most effective slides of glaciers and such subjects can be obtained in this way.

Warm the Slide before Mounting.—Gelatine is a substance which absorbs moisture, and which also undergoes decomposition much more readily when damp. To reduce this source of impermanence of a slide to a minimum it is a good plan to heat the slide about as hot as the hand can bear immediately before mounting.

How to Mask a Slide Quickly.—It has become axiomatic to say that every slide wants a different size and shape of mask, just as every print requires suitable trimming. Obtain some black needle paper and cut it into strips 3¼ inches long and of widths varying from ½ inch to 2½ inches. Placing these slips on a piece of glass, cut them with a sharp knife lengthways into two. Each half is thus given a clean, sharp edge. To mask slide, moisten one of these strips, and place on slide so as to cut off portion intended. Rub into contact with the gelatine film, which will, of itself, hold the strip sufficiently well. Mask all four sides in this way, taking care to keep the mask-pieces at right angles. Then trim off the overlapping edges with a pair of scissors.—*The Photographic News.*

Judging Density in Development.—The point at which to stop development is always most critical. Three factors should always be taken into consideration. First, the appearance of the negative image as seen by reflected light, i.e., when looking at the film. By this we can estimate the degree of detail in the deepest shadows. Second, the appearance by transmitted light, i.e., when looking through the negative. This enables us to estimate the relative densities of the lower middle tones. Third, the appearance of the image by reflected light, as seen at the back of the plate. This often enables one to form some opinion of the relative strength of the high lights. For the same batch of plates and developer these appearances are practically uniform. But different brands of plates vary very considerably, so that any one of the three above guides has to be duly allowed for.—*London Amateur Photographer.*

THE GLYCIN DEVELOPER.

OF this developer but very little is as yet known to the photographer, and to many it is unknown, its comparatively slow action placing it at first sight at a great disadvantage in the eyes of practical photographers. This is a great mistake. Glycin has numerous advantages that must make it a prime favorite in many fields of enlightened photographic labors.

Glycin is the muriate of paraoxyphenilamidoacetate, and comes into the market as as lightly yellowish crystalline powder. It is only soluble in water by the addition of an equivalent of potash, and forms, in solution with sulphite of soda, a colorless solution of great permanency. It is but little affected as to color by the addition of carbonate soda or potash. The solution keeps its energy for an indefinite period, even in cases of discoloring, which does not affect its working in the least.

Glycin Hauff must be classed among the slow-working developers, such as oxalate of potash and pyrogallic acid, and is remarkable for absolute clearness and the fine grain of its deposit. With glycin any desired density can be secured. As a developer for orthochromatic or color-sensitive and wet collodion plates it has no equal. In photographing the heavens and in microphotography, the minutely fine grain of its deposit, the great clearness and density make it an invaluable adjunct. We might add that glycin is the model developer for an amateur photographer, as it possesses the greatest latitude in exposure of any known developer. For lantern slides it is extremely fit, as the beautiful texture of its deposit of a rich brown-black color make the resulting transparency "a thing of beauty."

DEVELOPMENT WITH GLYCIN. — Glycin being one of the so-called slow developers, it should be used with carbonate of potash. It is advisable, as with all other developers, to give a two-solution developer the preference. Although a one-solution is the more convenient and gives good results also, is not, however, so thoroughly under the control of the operator.

TWO-SOLUTION DEVELOPER.

A.—Hot water, - - - - - 10 ozs.
Add in the order given.
Sulphite soda crystallized (Walpole), - 1¼ ozs.
Carbonate of potass., - - - ¼ oz.
Glycin, - - - - - ½ oz.
B.—Water, - - - - - - 10 ozs.
Carbonate potash, - - - 1¼ ozs.

ONE-SOLUTION DEVELOPER.

C.—Hot water, - - - - - 10 ozs.
Add in the order given.
Sulphite soda crystallized (Walpole), 1¼ ozs.
Carbonate potash, - - - 1½ ozs.
Glycin, - - - - - ½ oz.

If great keeping quality is desired, the sulphite may be increased, but this retards the development.

"Checking solution," a ten per cent. solution of bromide of potass.

For correctly timed exposures use one ounce of A, two ounces of B, and one ounce of water, or if the one-solution developer be used, one ounce of C (one-solution formula) and three ounces of water.

Great care should be taken not to touch the plate with fingers that have been emersed in hypo, as a trace of hypo will make a yellow spot.

The image makes its appearance in half a minute, showing first the high lights and last the details, the operation consuming about five minutes. Plates should not be carried too far, as they do not fix out.

TREATMENT OF OVER-EXPOSED PLATES.—Over-exposure may easily be remedied by the addition of from one to five drops of checking solution (ten per cent. bromide potass. solution) to the developer, or by increasing the amount of glycin (A) and reducing the amount of carbonate potass (B). Should the over-exposure be extreme, immerse the plate for from one to two minutes in a one per cent. solution of bromide of potash, and then develop with the developer as above.

TREATMENT OF UNDER-EXPOSED PLATES.—Although glycin is a slow developer, it will bring out details equal to metol or any other rapid developer. Ample time must be allowed for it to act, when the faintest impression of light that the plate has received may be brought out. The most advisable formula is:

One part of one-solution developer to six parts of water. Where great density is desired, one part of one-solution developer to six parts of water, or one part of A to two parts of B, two-solution developer.

TREATMENT OF DOUBTFUL EXPOSURES.—Place the plate in a developer composed of two parts of A, one part of B, two parts of water, adding five drops of bromide potass. solution. If details are noticeable in thirty seconds, the plate is over-exposed and more bromide should be added. Should the plate show harsh high lights first, it is under-exposed and more B should be added, and in case this does not soften the negative more water should be added to allow the details to come up with the high lights.

To Photograph Glittering Metal Objects.—Under ordinary circumstances the shiny places produce very objectionable high lights on the negative. If the metal is painted and quite dry, it will often suffice to dust the shiny places with finely powdered starch, arrow-root, flour or any such (innocent) powder. In the case of bright steel, etc., the shiny places may just be dulled by dabbing them with putty. In the case of glass objects care will be needed in applying the putty so as not to leave patchy marks. In the case of solid silver, gold, and plated objects, gently breathe on them, and then with a tuft of cotton wool dust the parts with very fine powdered whiting. If the objects are hollow (e.g., goblet, teapot, etc.), place inside them a few pieces of ice a few moments before making the exposure, and wait until a very fine dew just begins to deposit from the surrounding moist, warmer atmosphere. This produces a fine "frosted-silver" effect, which tells well in a photograph. Do not, however, wait too long, or the dew specks gather into large drops, and the effect passes away. As soon as the exposure has been made, the articles should at once be dried and polished.

PHOTOGRAPHY IN THE ZOO.

BY D. LE SOUEF,
Director Zoological Gardens, Melbourne.

ANIMAL photography is a study that needs a great deal of patience to get satisfactory results, and the many failures in getting good pictures is caused by the operator either not having allowed himself enough time, or else lacking sufficient patience, as it is very trying to see the animal moving about in all the places except the one in which you want him, and you cannot drive or tie him up, and many a time I have only wished I could when the subject has been unusually restless and my stock of patience beginning to give out. Hand cameras are largely used, and for many purposes they are very useful; but, to get sufficient detail, time exposures are, as a rule, necessary, but in many cases that is almost impossible to get. Take a zebra, for instance—its tail is almost always on the move when it is slightly excited by seeing a camera about, and efforts made to secure its picture, and when its tail is not moving its head is—and probably some of you have seen photographs of that beautiful animal; but in most cases the tail is either a blurr or missing altogether. It is also very aggravating, when having just taken a picture, in which the animal has moved slightly, to see it remain perfectly still for a few seconds, but off again before you have time to change your slide.

In taking photographs of domestic animals, the time of day makes little difference, as you can always choose your position; but in a zoological garden the case is very different. Most of the cages face the east to enable their occupants to get the first rays of the rising sun, a very necessary precaution in winter; therefore, if the object is to secure pictures of the carnivora and other occupants of the cages, the early morning is the most favorable time, but at the best it is very difficult to get good photographs of animals in cages, there being generally insufficient light for a quick picture, and the iron bars in front do not add to the animals' beauty; but when any of the larger carnivora are in the exercising yard, which is open on top and at the back, they

are then in the full light of day. The time does not make much difference, but it is advisable to take your picture on a slightly cloudy day, otherwise the shadow of the bars above will take away from the value of the picture, and also, if the sun is shining brightly, halation is apt to occur. In the case with the grass-feeding animals and birds in the various enclosures, you can get pictures at any time of the day in some of them, for if the light does not suit one it probably will another. Very many amateur photographers go to the gardens with their camera for an afternoon, and expect to bring back six or more good pictures. Well, they are fortunate if they get one or two, as, although they may take the six pictures, they are seldom good enough to be made public; as, although amateurs with cameras are almost daily in the gardens, the results are not often seen—take our exhibition here as an instance.

The best lens to use is a rapid rectiliner, working with good definition, with the largest stop, say at *f*-8, as the subjects will, probably, not wait for a long exposure; and, of course, I need hardly add it is very necessary to have a finder on, in case the animal shifts its ground after you have your slide in. The twin lens cameras, with finders the size of the picture, are certainly the best for animal portraiture, as you can keep the animal in focus although it may move.—*The Australian Photographic Journal.*

Platinum Toning Bath.—Two grammes of platinic chloride and 60 grammes of neutral sodium oxalate are dissolved in 100 c.c. of distilled water and exposed to the light. The platinic chloride is reduced to the platinous condition, but is not precipitated, the reduction being finished when the yellow color has changed into an orange, which no longer increases in intensity. The bulk of the solution is then made up to one litre, and 5 grammes of metaphospooric acid added. The bath is then ready. Toning should be carried out in a weak light, the operation being performed as follows: 1st, a thorough washing; 2d, toning; 3d, a fresh washing; 4th, five minutes' immersion in a 5 to 10 per cent. solution of sodium or ammonium chloride; 5th, a fresh washing; 6th, fixing and washing in the usual manner.—*Bulletin Société Francais.*

TWO LITTLE WRINKLES.

BY HENRY EVERETT.

IN attempting to comply with a request by the editor for a contribution to the pages of the *Camera Club Journal*, I fear I have undertaken a responsibility which is easier in the promise than the fullfilment, and that I am but ill qualified to write for so experienced and critical a circle as the members of the Club. However, having undertaken to do what little I can, I find some consolation in the thought that there may possibly be found a few readers to whom two "wrinkles" affecting trifling points in photographic practice may prove useful. The methods I propose to describe are so exceedingly simple that they have probably occurred to hundreds of amateurs besides myself. I can only say I have never seen either of them referred to in any publication, or heard them mentioned by any photographer, and this must be my excuse for venturing to put them forward on this occasion.

First, then, with regard to the insertion of clouds in bromide enlargements. I possess two handbooks devoted exclusively to enlarging. One does not refer to skies at all, and the other describes an elaborate system of masks and pencil marks by means of which (if you are lucky) separate exposures may be given for sky and foreground, and the whole developed at once without showing a join. My plan is this: First expose for the foreground, protecting the sky, if necessary, by shielding the paper with a piece of card cut roughly to the shape of any trees, &c., projecting into it; then proceed to develop, and when the image has nearly attained the requisite density pour off the developer and flood the paper with the usual acid, clearing bath, if using ferrous-oxalate, or wash for a few minutes under the tap if metol is used. Next put the cloud negative in the lantern, and adjust the print on the easel to receive the sky selected. This can be done with ease and certainty with the yellow cap on the lens, as the forground is already visible and the exact position of the clouds can be readily determined. Then expose, shielding

the lower portion of the paper with a card and develop, and by the time the sky is sufficiently indicated the landscape will have attained proper density, and after clearing or washing the print may be fixed. The partial development of the foreground appears to cause a decrease in the sensitiveness of the bromide paper, and the exposure for the clouds must, therefore, be longer than would ordinarily be the case. The correct time may be ascertained by making a test-exposure on a small piece of paper which has been placed for a few minutes in the developer and afterwards washed, thus bringing it to approximately the same condition as that used for the print. I see no reason, either, why the exposure and development of the sky should not proceed simultaneously, the developer being brushed or sponged over the paper while affixed to the easel. I have not tried this method, but the first mentioned plan has for some years worked satisfactorily in my hands.

Now for my second "wrinkle." In mounting large bromide prints I was much bothered by two difficulties. As soon as the mountant was applied, the print, being dry, began to curl up, and all sorts of devices had to be contrived to make it lie flat and to prevent the mountant getting on to the front, and when this had been got over and the print was mounted, another difficulty arose from the cockling of the mount. The following procedure removes both these difficulties at the same time. Place the mount face downwards on the table, and go over the back with a brush or sponge well charged with water. Put the print with its back in contact with the wet back of the mount, leave them under slight pressure for a minute or two, by which time the print will have absorbed sufficient moisture to make it lie smooth during the application of the mountant, and the operation of mounting is thus simplified. When dry the whole will be quite flat and free from cockling, as the wetting of the back of the mount will counteract the "curl" in the other direction.

I conclude, as I commenced, by expressing the hope that these very simple hints may be of service to some of the less expert readers of the *Journal*, even if they are already well known to many.—*The Journal of the Camera Club.*

THE JOLY COLOR PROCESS.*

THERE is finally a last method by which the triple operation is effected on only one surface. The sifting of three simple colors is effected in this case not by means of colored glass plates, but by means of a translucent plate covered mechanically by grains of three colors.

Let us imagine, in fact, a piece of paper, the surface of which is completely covered by lines alternately red, yellow and blue, the rays being as fine as possible, of equal width and without solution of continuity; if this sheet of paper is looked at closely the three colors of rays can be distinguished, but at a distance they are confounded to a single color-white, if looked at by transparency, and gray if looked at by reflected light, supposing of course that the three colors have been combined in such a manner as not to give an undue predominance to any one color, and if the image in the camera is received on this sheet of paper, this image, viewed from a distance, will be the same as if the sheet of paper were really white.

Such a sheet of paper has the remarkable quality of furnishing, either by work of an artist executed in black pencil, or by light, by means of direct or indirect processes of the ordinary photographic, a picture, in which the natural colors are reproduced with a certain degree of truth.

If it is desired to produce, for instance, red coloring on that paper, which presents a uniform neutral color, it is sufficient to crosshatch by means of a black pencil the yellow and blue rays.

For producing violet coloring, the yellow rays are crossed out in the same manner, and, if desired to make the violet not so glaring, the red and blue rays can be slightly shadowed.

What an artistic hand produces on that paper, nature can produce also.

In fact, let us suppose that the paper is covered, on the same side on which are those rays, by a preparation, which gives

*Copy of translation of the alleged anticipating French specification of Ducus-Duhauron, No. 83061 of 1868.

directly under the influence of light a positive image, and that on the back of the paper, that is to say, on the side not covered by rays, is received the image of the camera; the three simple colors will then be sifted through the paper and will form each their positive image, that is to say, their impression in (clair) white on the ray of corresponding color; the three impressions will be formed with equal rapidity in spite of unequal degree of actinism of the three simple colors, if care has been taken to impart to each of the three kinds of rays a translucency inversely proportional to the photogenic action of these colors on the preparation used; this unequal translucency can be produced by means of dark rays, previously ruled on the back of the paper, and the most simple means of obtaining these dark rays consists in negatively sensitizing by chloride of silver, for example, the back of the paper, and in exposing the right side to diffused light until it has formed by its unequal action through the different colored rays, the dark rays, having the desired degree of opacity.

In order to make this method of three kinds of rays thoroughly practical, the indirect processes of photography ought to be preferably employed. We shall have once for always only one plate of mica covered on one side with red, yellow and blue rays of intense color, and on the other with rays unequally dark. Then this mica plate is used as a sieve for obtaining on other surfaces brought in contact with it (paper, glass and the like), a negative image on bromide of silver; each of these negatives will in its turn furnish positives of black color, mica, glass, etc.; then it only remains to apply each of these positive images on an opaque surface or on a transparent one, covered mechanically with red, yellow * and blue rays corresponding one by one to the position of the rays of the mica plate, which was used for sifting the rays of simple colors.

The colored rays can be ruled mechanically or chemically, for instance, by chromo-lithography or by means even of the photography itself, by using black screens with transparent rays, reduced by the camera, and through which the preparations of

* In a part not here translated Duhauron says he can use "greenish yellow" instead of "yellow."

gelatine (or gum albumen, etc.), bichromated and colored, are exposed to the action of light.

The three sorts of rays, instead of being ruled on the same plate can, for the sake of greater facility be ruled on three different plates, which are afterwards superposed in such a manner that the juxtaposition of the rays is produced.

THE LANTERN AS AN EDUCATIONAL INSTRUMENT.

BY J. J. VEZEY.

TO those interested in the progress of the lantern there are a few facts more encouraging than its advance in the past few years as an educational instrument. If any one a short time back had suggested that a lantern was a necessary item of school-machinery, he would have been laughed at, and would have been considered more foolish than those who recently advocated the introduction of pianos into Board Schools. Yet, what do we see to-day? At colleges, scientific institutions, and all large educational establishments a lantern is one of the most important instruments, both for the class-room and the lecture-room, and the most eminent lecturers of the day would hesitate to deliver a discourse unless they had a lantern for the illustrations.

It would be difficult to over-estimate the important part the lantern has filled in popularizing science. There are few subjects in which it has not assisted. Its usefulness has been enormously increased by the advance made in photo-micrography. Botanical, physiological, natural history and other objects can now be easily photographed under the microscope, and from the negatives so taken lantern slides are made, and objects which in their natural condition are quite invisible to the naked eye can be seen with all the beauties of their details magnified into pictures of twelve feet diameter and over. In illustrating lectures on physical science the lantern is invaluable. By means of the arrangement for horizontal projection

it is possible to perform experiments before a large audience, which could formerly be seen only by a few persons at a time. To name only such subjects as spectroscope, the polarization of light, crystallization, magnetism, etc., is quite sufficient to recall the value of the lantern in the lecture-room.

In all the subjects which require the assistance of the microscope the lantern is indispensable, for whereas it is only possible to show a microscope to one person at a time, the object can be enlarged by means of the lantern so that hundreds can see it together.

This increased use of the lantern has largely stimulated lantern-makers to improve its construction and method of lighting, because for some of the uses named an old-fashioned instrument, lighted with oil, would be of little value. Perhaps the most modern example of the increased popularity of the lantern may be found in its recent application to the exhibition of what are called "living pictures." When Edison brought out his kinetoscope a few years ago, it was considered a very clever thing, but it excited nothing like the interest it has evoked since its principle has been applied to the lantern, and it is gratifying to all lanternists to note the enthusiastic way in which the public are willing to pay their money to see the various exhibitions now open for the display of moving pictures by means of the lantern.

To review the present position, it may be said that what was considered merely a child's toy some twenty-five years ago is now regarded as an important educational instrument, and makers of the lantern and workers with it should do all in their power to improve and adapt it for the useful future it has before it as an illustrator of unsurpassed value.—*The Optical Magic Lantern Journal and Photographic Enlarger.*

Miss Dudely.—"There is no object so beautiful to me as a conscientious young man. I watch him as I do a star in heaven."

Miss Snobberly.—"That's my view, exactly. In fact, I think there is nothing so beautiful as a young man, even if he isn't conscientious."

WEIGHTS AND MEASURES.

BY J. F. G. NORMAN.

IT does not require a long apprenticeship to photography to discover that there is something very unsatisfactory about our system of weights and measures. I should have said our plurality of systems, for there are four, all of which we have more or less to deal with it.

Avoirdupois weight, by which our solid chemicals are sold, and which is our legal system for buying and selling solid goods of every description, has its lowest weight the drachm, or one-sixteenth of the ounce, and runs

16 drachms = 1 ounce.
16 ounces = 1 pound.
&c., &c.

Apothecaries' weight, used for dispensing medicines, commences with the grain, and runs

20 grains = 1 scruple.
3 scruples = 1 drachm.
8 drachms = 1 ounce.
12 ounces = 1 pound.

Troy weight, by which gold, silver, platinum, and the more precious of the metals are sold, has the same unit the grain, and runs

24 grains = 1 pennyweight.
20 pennyweights = 1 ounce.
12 ounces = 1 pound.

Liquid measure commences with the minim, and runs

60 minims = 1 drachm.
8 drachms = 1 ounce.
16 ounces = 1 pound.
20 ounces = 1 pint.

Liquid chemicals are sometimes sold by this measure, but they are equally often sold by weight.

The first and most obvious difficulty that will be noticed in dealing with our system is that though we buy our materials by

avoirdupois weight, it is absolutely impossible to employ it for our formulæ, unless unusually large quantities are dealt with. The drachm, not a convenient weight at the best, is obsolete, and the ounce contains the odd number of 437½ of grains, which is common to apothecaries' and troy weights. We have no alternative, however, but to import this weight, the grain, from another table, and it has come to be used commonly both in connection with weights of the avoirdupois series and in connection with the series to which it properly belongs.

This constitutes one of the principal pitfalls of our present system. Let us take an ordinary formula and see how it may mislead:

Chloride of gold, - - - - 15 grains.
Acetate of soda, - - - - 1 ounce.
Water, - - - - - - 1 pint.

Does the ounce there mean 437½ or 480 grains?

Nobody can tell except the individual who originated the formula.

Let us now suppose that it is known by some means that 480 grains were intended to be taken. An ounce of acetate of soda as it is purchased contains but 437½ grains, therefore if 480 grains are required, more of the salt must be purchased than is actually required, leaving a surplus to be stored away; in some cases to go bad before it is again required.

In the particular instance of this formula probably it would be unimportant which way it was read, but a simular ambiguity in a formula, for instance, for an emulsion might be very serious. Let us say a formula was written containing—

Nitrate of silver, - - - - 1 ounce.
Bromide of potassium, - - 320 grains.

With the 437½ grains of nitrate of silver the bromide would be in considerable excess, and with 480 grains the silver, a matter of the utmost importance.

Our liquid measure is a most extraordinary jumble of avoirdupois and apothecaries' weights. The ounce is the measure of the bulk of an ounce avoirdupois, 437½ grains of water. This has been divided, like the ounce apothecaries' weight,

into 480 parts called minims, and consequently a minim of water weighs the awkward amount 437½ four hundred and eightieths of a grain, or $\frac{175}{192}$. As sixty minims are called a drachm, we have the ounce, which, when dealing with water, can be weighed by apothecaries' weight, while the drachm has no connection with any of the systems of weights.

If the sixtieth multiple of the minim, instead of being called the drachm, and the four hundred and eightieth, instead of being called the ounce, had been called, like the minims, by names which would prevent them being confused with weights in common use, the discrepancy between the weight of a minim of water and a grain would have been of comparatively little importance, but it happens that this very discrepancy, by creating an ambiguity somewhat similar to that in the use of the word ounce, prevents the adoption of a system of writing formulæ which would have enabled us to avoid all our present difficultities without necessitating any change in the actual weights in our scale trees or the graduated measures which we use.

It has been suggested that all formulæ should be written in "parts," and doubtless this is a method that would long since have been generally adopted in photography if there could have been a common understanding of how "a part" of a liquid was to be construed.

In the formula

Sulphite of soda, - - -	10 parts,
Sulphuric acid, - - - - -	1 part,
Water, - - - - - -	100 parts,

there are three different interpretations. Supposing that 10 grains of sulphite of soda were the amount proposed to be used; firstly, it might mean that 1 minum of sulphuric acid and 100 minims of water were required; secondly, it might mean 1 grain by actual weight of sulphuric acid and 100 grains of water were to be added; and thirdly, it might mean that the measure of 1 grain of water of sulphuric acid was intended.

It is true that few would write a formula in which parts of

a liquid by actual weight were intended to be taken without distinctly expressing that intention, but for reasons which will be referred to latter, even if we were to agree that "parts" were to be construed as grains by weight of solids, and minims by measure of liquids, some confusion might still sometimes arise.

The French metric system is fast becoming the system in use all over the continent of Europe, and it is rapidly becoming the system employed by our own scientists, and even were its defects greater than they are, the advantage of using a system in common with nearly all other civilized nations ought to cause its adoption by photographers.

As a system nothing can exceed it in simplicity. There are no tables to learn, for its divisions are the natural ones of our numeration, and though each weight and measure has a name of its own, its name is in itself an indication of its relation to the unit.

The unit of weight is the gramme, which is equal to 15.432 grains.

1 milligramme	=	$\frac{1}{1000}$ gramme
1 centigramme	=	$\frac{1}{100}$ "
1 decigramme	=	$\frac{1}{10}$ "
1 gramme	=	1 "
1 decagramme	=	10 "
1 hectogramme	=	100 "
1 kilogramme	=	1,000 "

The unit of measure is the litre, which equals 35.216 fluid ounces. For scientific purposes, however, the cubic centimetre, the one-thousandth of a litre, is used, and quantities less than a litre are expressed in cubic centimetres.

1 centilitre	=	10 cubic centimetres (c.c.)
1 decilitre	=	100 " " "
1 litre	=	1,000 " " "
1 decalitre	=	10 litres
1 hectolitre	=	100 "
1 kilolitre	=	1,000 "

There is no absolute necessity even to know the names of these divisions. All quantities can be expressed in grammes or cubic centimetres, or decimal fractions of them.

The cubic centimetre bears the relation to the gramme that our minim ought to bear to our grain—that is, it is the measure of one gramme of water. It has already been pointed out that the difficulty of using "parts" arises from the discrepancy. Had the grain and the minim agreed as the gramme and cubic centimetre do, a formula written in parts could have been used either with our own weights and measures, or with those of the metric system without the slightest difficulty, but since we cannot get on with our own system, we may as well take the opportunity of failing into line with our neighbors.

In conclusion a hint that may be useful. In translating a formula exrpessed in metric terms, it will usually be sufficiently accurate to multiply the grammes by 10 and the cubic centimetres by .1 f. The result taken as grains and minims will be about two-thirds the quantity indicated.

Pin Making.—England depended upon France for its supply of pins until 1626, when John Tilsby introduced the manufacture into Gloucestershire. His business grew to such an extent that it is said he gave employment to 1,500 persons; at any rate, his pins, Stroud pins, as they were called, gained a high reputation. In 1836 the manufacture was introduced into Bristol and Birmingham, the latter place ultimately becoming the greater center of the industry.

Pins in America made their first appearance during the last century. In 1775 a prize was offered to the colonists of Carolina, who introduced the first native pins and needles. During the war of 1812, when, owing to the restrictions upon commerce, the price of pins rose to $1.00 per paper, the manufacture was actually started in the United States, but does not seem to have met with success, as the enterprise was soon abandoned. The industry was not fairly started in this country until the year 1836.

This idea of between two evils choose the least, I think, is one of the most misleading of our time. Supposing you went into a place for a glass of lemonade with an egg in it, and the proprietor said, "I have not any fresh eggs, but I have one bad one and one spoiled one," which one would you choose? I think you would say, "I'll wait until the hen lays."—*John B. Finch.*

The Editorial Dropshutter.

Untaxed Alcohol for the Manufactures and Arts.—The Joint Select Committee created at the last session of Congress to investigate and report upon the question of the use of alcohol free of tax in the manufactures and arts, have prepared a series of interrogatories, which will be distributed throughout the country to such parties as are thought to be interested in the question.

The report of Mr. Henry Dalley, Jr., who was commissioned to investigate the workings of foreign laws governing the use of untaxed alcohol in the manufactures and arts has been submitted, and contains very full and extremely valuable data covering Great Britain, Germany, France, Belgium and Switzerland.

It is the earnest desire of the committee to secure all possible information bearing upon the subject, and it is hoped that parties interested will submit their views to the committee promptly. Sets of the circular letter and blank for replies will be supplied to any applicant by addressing the Chairman, Room 21, Senate Annex, Washington, D. C.

The Committee, which is composed of three members from each House, will probably assemble in Washington soon after the middle of November for the purpose of formulating a report to Congress, accompanied by the draft of a law which will place domestic industries on as favorable a basis as similar industries in foreign countries. During their sessions in Washington hearings will probably be given in order to supplement the information obtained through the interrogatories above set forth. Due notice of the time of such hearings will be given to the public.

Photographing the Eye.—At a recent meeting of the Paris Academy of Medicine, M. Guinkoff stated that he had successfully photographed the interior of the eye. The advantages of this method are important, since it enables actual pictures of the disease of the retina to be secured and compared from time to time to determine whether disease processes of the eye progress or not. The picture is made in two seconds. The apparatus can thus serve as an ophthalmoscope, and any number of persons can thus observe the results.

Another Joke Against Photography.—The following jokelet, which a gallant detective officer has just let loose, is not bad. A murder had been committed in a busy northern town, and a number of

collotype portraits of the murderer were rapidly printed and circulated among the chief police centres, and the chief of the detective department was much astonished to receive a wire from a London office, stating, "Have arrested five of the wanted men, and have every prospect of securing the sixth before night." Collotypes do differ certainly, but hardly so much as to warrant this joke.

A large order for the Lavette patent envelope for mailing photographs, has been received from the Hawaiian News Company, Honolulu, Hawaiian Islands. This straw shows how American inventions of merit make their own opening in foreign lands.

A Roentgen Pill.—The X-rays so dislocated the credulity of the ordinary man, says the Cork *Constitution*, that he will now believe anything possible in connection with them. He will therefore believe readily in the "Roentgen pill," which a contemporary now describes in detail. The Roentgen pill consists of a small capsule charged, not with medicinal material, but X-rays. You swallow it, and straightway you are illuminated within. Your "inside parts," as Mr. Kipling's (this the C.C., but we suppose Leland is meant—Photo.) Hans Breitman would say, become as day. The advantage is that the inquiries of the doctor are much facilitated. To any one needing a light meal we recommend the Roentgen pill—if we can obtain it.—*Photography*.

A Photo-Cycle Trip.—Last week three cyclists started from London on a tour round the world. They are Mr. Foster Frazier, who recently visited Asia Minor, Mr. Edward Lunn, brother of the editor of *Travel*, and Mr. F. H. Lowe, nephew of Sir Gainsford Bruce. Photographic and literary records will be taken along the route, and probably published upon the return of the travelers.

To Picture Historic Ground.—The Teachers' Photographic Association of Philadelphia lately visited Valley Forge and was conducted over the historic ground by the Assistant Superintendent of Schools, C. Henry Kain. After leaving Valley Forge station the party went by way of Valley Creek to the site of the headquarters o f Lafayette and Knox, and, following the line of the intrenchments, struck the camp road at the point where stood the Washington redoubt. Leaving there, the route was by Fort Huntingdon to the ford over which the army crossed the Schuylkill river when camp was broken at Valley Forge. A visit was then made to the site of the huts, traces of which still remain, that were occupied by the soldiers under the command of Steuben and Count Pulaski, and the route was continued down the road to Port Kennedy, from which station the party returned home.

A Stupendous Survey.—Advices are received from Washington that the Coast and Geodetic Survey has just concluded its labors in the field upon the most stupendous geodetic survey ever undertaken in any country, in which photography in the later years has formed a prominent factor, and which gives the United States the longest base line upon which to establish subsequent surveys in existence in the world. It is known as the transcontinental arc, and lies along the 39th parallel of north latitude, extending from ocean to ocean. Its eastern end is at a point on the Atlantic ten miles south of Little Egg Island Lighthouse, below Cape May, and its western end is six miles north of Punta Arenas Lighthouse on the Pacific, above San Francisco several miles. According to the radius of the 39th parallel as given by Bessel, the famous astronomer of Koenigsberg, Germany, who first calculated the diameters of the earth, and measured the distance from the earth to 61 Cygni, the nearest fixed star, the length of the arc as measured by the Coast and Geodetic Survey officials is 111 feet in error, and according to the radius of the same parallel as fixed by Sir Andrew Clarke, of Glasgow University, the error is 98½ feet. But General Duffield, Superintendent of the Survey, declares that these variations from the heretofore established standards show error in them and not in the calculations of his scientists. By the measurements made on the line, and which have been aggregated in the office here, the arc at sea level for the entire distance (that is, following the curvature of the earth's surface) is 2625.8 miles in length. The establishment of the radius of the 39th parallel from these measurements is a matter for further calculation.

The value and vastness of the work just accomplishd cannot be intelligently appreciated by the unscientific mind. It was inaugurated by the survey nearly, if not quite, half a century ago. Progress upon it has been spasmodic, but some work was done every year since the beginning. It has cost the Government about $1,000,000, but the expenditure is said by the officials to be fully justified by the importance of the project. Russia and China are the only other countries on the globe wherein a base line of anything like equal magnitude is possible, and in neither one is it likely to be surveyed for many years. The longest base line heretofore surveyed was that in India, running north and south, about 1000 miles in length. European scientists have been greatly interested in the progress of the American arc, and its completion will doubtless be the occasion of the receipt by the Coast and Geodetic Survey officials of many congratulations from abroad.

Improved Stereopticon.—An apparently valuable instrument has been constructed by combining the stereopticon principle with the microscope, by which the most minute object in every detail can be thrown upon a screen in uncommonly large proportions.

Such an instrument would prove invaluable in showing the different kinds of bacteria and their operations in diphtheria, tuberculosis, etc., or in the deterioration of the blood by the infusion of poisons. Many remarkable wonders in the botanical world would be brought to light, unseen before, and an innumerable number of objects that in consequence of their minuteness we have never seen, and with which we are entirely unacquainted.

This wonderful magnifying machine was on exhibition at the New York Academy of Science in March, when the operator affixed to the lantern slide a flea, which had ceased its nocturnal exploits, when instantly it was shown upon the screen in all its beautiful kangaroo proportions, fully six feet in length. A mosquito's leg measures eight feet.

This micro-stereopticon certainly must prove of immense value in very many ways; yet we would not advise any except medical practitioners to examine a drop of the purest water they could possibly find.

The Camera Club, 113 West Thirty-eighth Street, New York.—The regular meeting was held on Tuesday evening, October 13th, at half-past eight o'clock. The Committee on Photographic Literature and Meetings announced: (1) Demonstration of a new paper. (2) Exhibition of a new camera by Mr. A. C. Wilmerding, of the Obrig Camera Company.

News From Mercury and Venus.—The physical conditions which prevail upon our sister planets very properly constitute a theme of widespread mundane interest. It will, therefore, be noted as a significant addition to our knowledge of the subject that recent observations at the Lowell Observatory, at Flagstaff, Arizona, appear to confirm the discovery of the distinguished Italian astronomer, Schiaparelli, a few years since, that the two "inferior" planets, Mercury and Venus, rotate upon their axes in exactly the same time in which they revolve about the sun. The period of rotation can only be determined by a critical examination of the surface markings of the planets, which are exceedingly slight and vague. Besides, the elusive Mercury, which only appears to the naked eye about once in six weeks, as morning and evening star, alternately, is ever so close to the sun as almost totally to defy attempts at observation. Schroeder,

one of the contemporaries of Herschel the elder, assigned it a rotation period of a little more than twenty-four hours, while he considered that of Venus to be a trifle shorter. But his conclusions had long been regarded with suspicion.

If the Lowell determinations are correct, the behavior of these planets is similar to that of the moon with respect to the earth. One hemisphere is perpetually exposed to the glare of the sun and knows no night, while the other is constantly shrouded in darkness, relieved only by the glimmerings of the stars and planets, for neither planet is known to have any satellite. The sidereal period of Mercury (its "year") is about 88 mean solar days, and that of Venus about 225 days. As a result of this singular law of axial rotation each planet's "day" will be as long as its "year." And in the case of Mercury, whose orbit is very eccentric, the sun will seem to oscillate, *i.e.*, swing back and forth in the sky (instead of rising and setting as on our planet), to an extent of about 47 degrees. And if, as Schiaparelli asserts, the axis of Venus is perpendicular to the plane of its orbit, there can be no variation in the seasons of its illuminated hemisphere, which perpetually resemble those of the earth at the time of the equinoxes, except that the temperature is proportionally heightened by reason of its being 25,000,000 miles nearer the sun.

The Lowell spectroscopic investigations indicate that Venus has a very dense atmosphere, while Mercury has none at all. The inevitable, and indeed perfectly legitimate popular query as to the habitability of these planets cannot yet be answered by science. Inferentially, Mercury could not entertain beings like ourselves, while Venus, our twin-sister world, might be able to do so. But beneficent Nature has an infallible method of harmonizing circumstances, and we must be careful in respect of deductions.

Schiaparelli seems to be endowed with phenomenal vision. His extraordinary researches upon Mars, nearly a score of years ago, resulting in an entirely new and surprising areography, are being verified at the Lowell Observatory, which has lately succeeded in glimpsing the "doubling" of his famous "canals." Astronomical honors are coming thickly to this newest aspirant, which has been the first to hail the return to vision of the celebrated companion to Sirius and also that of Deimos, the outer tiny satellite of Mars.

"**Parker** uses a great deal of cologne, it seems to me. Awful bad form!" said Hawkins. "It would be in you," said Hicks, "but it's family pride with Parker. He comes of colognial stock."—*Atlanta Constitution.*

Photographic Hints and Formulæ.

Improving Process Negatives.—Dr. Eder, in the *Photographische Correspondenz*, gives the following chemical method for modification of the size of the dots, which has been used with great success in the Vienna Technical School. For such a purpose the image of the screen may be more pronounced than usual in the negative. Smaller stops may be used, and the pre-exposure can be utilized with much effect by means of a sheet of white paper, say for twenty minutes, at *f*-50 to *f*-60 with a square stop. The exposure is then made for the original, with a round stop, at 5-15 to 5-16, and should be in proportion to the pre-exposure, which in this case would be six to ten minutes. Develop with a 4 per cent. iron and sulphate of copper developer. Before fixing, the negative is intensified with hydroquinone and silver. Fix with cyanide of potassium, wash, and whilst still wet intensify by dipping in a solution of

Sulphate of copper - - -	120 parts
Bromide of potassium - - -	4 parts
Water - - - - -	1000 parts

followed by quick, plentiful washing in water, and a bath of one part of nitrate of silver to 10 or 20 parts of water and a few drops of nitric acid. The negative is now reduced in cyanide of potassium solution, to which has been added a solution of iodine and iodide of potassium. This is carried so far that the dots in the shadows are fine and sharp, but still black on a transparent ground. After another washing intensification with silver and copper, as before, is repeated, and the negative is again thoroughly washed, and then intensified with lead. This bath consists of

Ferricyanide of potash - - -	6 parts
Nitrate of lead - - - -	4 parts
Water - - - - -	100 parts

Filter, dip the negative in the same, whilst still wet, till a yellowish white color is attained. Wash thoroughly in running water, until the negative is whitish, then flow over it a solution of one part of actic acid to one part of water, wash thoroughly and blacken with ammonium sulphide. The reintensification with copper may be omitted if the negative is clear and plucky after development. Dr. Eder recommends this method of correcting process negatives as practical and safe.

Plate Backing.—

Powdered gum arabic,	1 part.
Caramel,	1 part.
Burnt sienna,	2 parts.

Grind together with as little water as possible to make a stiff paste, then thin it down with methylated spirits until the consistency of cream. Apply with broad camel-hair brush.

The Fish Glue Half-Tone Process —The author recommends the use of gum acacia for this purpose, the solutions being as follows. For use, three ounces of No. 1 must be mixed with one ounce of No. 2. No. 2 will keep indefinitely, but No. 1 will not.

No. 1.

Le Page's glue,	3 ounces.
Albumen,	1 ounce.
Water,	4 ounces.
Bichromate of ammonium,	80 grains.

No. 2.

Gum acacia,	½ ounce.
Water,	8 ounces.
Aqua ammonia,	¼ ounce

—*H. J. Lloyd.*

Photography with Bichromated Gum.—The process of photography with bichromated gum has one advantage over the carbon process as usually worked, that development can be carried out without transfer, while the results are as permanent in the one case as the other, and the tone can be as varied. On the other hand the gum process possesses the drawback of reproducing half-tones but imperfectly. It is almost impossible to obtain uniform and regular coatings, which shall be throughout perfectly soluble in those portions which correspond to the half-tones.

After many attempts the author has succeeded best with the use of acidified gum arabic, rather than that in a neutral condition. A feeble acid is all that is required, a 10 to 15 per cent. solution of citric acid mixed with an equal quantity of a saturated solution of gum arabic, and is employed in the same way as indicated for the neutral gum by M. Fouille-Ladeveze.—*Robert Demachy, Bulletin Societé Francais.*

The time when the cold water party largely predominated—during the flood.

Photographic Literature.

An Important Announcement.—The *first* part of the "List of Private Libraries," compiled by Mr. G. Hedeler, of Leipzig, will be ready in December. It will include more than five hundred important private collections of the *United States and Canada.* The statements as to the number of volumes, the principal features, etc., of the separate collections are furnished, almost without exception, by the owners thereof. The index of subjects appended enables the reader to determine at a glance which collectors devote themselves to each of the specialties indexed. The *second* part, now being prepared, will contain about the same number of considerable private libraries in *Great Britain.* Those happy possessors of libraries with whom Mr. Hedeler has been unable to communicate are requested to furnish him with a few details as to the extent of their treasures, and the special direction to which they devote themselves. It is obviously to the interest of bibliographical science that a work of this kind should be as complete as possible.

Der Pigmentdruck und die Heliogravure. — By Dr. Josef Maria Eder. Vol. IV., Part 2. 248 pp. Wilhelm Knapp, Halle a.S., Germany.

This part of Dr. Eder's exhaustive work completes not only the fourth volume of Eder's "Ausfürleches Handbuch der Photographie" (Copious Manual of Photography), but the series as well. The last part is a fitting close to this grand work, which covers the whole field of photography—historical, chemical, optical, mechanical—and the theory and practice of every department of the art-science. Studio and laboratory literature and practical manipulations are all exhaustively treated. The four volumes present a complete photographic library of reference,—a fountain at which one may draw, no matter what photographic information may be wanted. That no expense was spared by the great publishing house of Wilhelm Knapp in properly bringing out this work, may be gleaned from the fact that in the four volumes just completed there are no less than 1905 illustrations. The present part treats of the beautiful carbon process and the intaglio or heliogravure process. Every section of this grand work may be bought singly. Dr. Eder deserves the thanks of the whole photographic community for his work, not only journalistic but practical, which has made his name a photographic authority throughout the world.

Die Chromo-Lithographie. Von Friedrich Hesse. Wilhelm Knapp, Halle a.S., 1896. Prepared with especial reference to the modern photographic processes which form the foundation for present methods. Embellished with 15 chromo-lithographic plates and 82 illustrations in text.

The work is gotten up similar to the Encyclopedia series of Messrs. Knapp, although it is not numbered among the above set of photographic literature. The book is divided into two parts:

1. The direct chromo-lithographic process, treating upon the different processes, the various materials, apparatus, utensils, and hand and power presses required. The manipulation and preparation of both tint and zinc process is given at length, then follows the preparation of the colors and the production of the tint blocks. The chromatic process is dealt with at length in all of its phases, closing with directions for printing, stripping pictures, transparent effects, prints on sheet iron or tin and embossing.

2. Procedure in connection with photographic processes. This commences with instruction for making the negatives, wet, dry and reversed, retouching, a full description of the Lichtdruck process, closing with the photo or half-tone chromo-lithography, an appendix on the three-color process.

The Illustrated Catalogue of the Royal Photographic Society's Exhibition, September to November, 1896.—The catalogue proper contains the list of exhibitors and is illustrated with numerous direct reproductions in the text. The supplement contains thirty-two plates in half-tone, made by the Meissenbach Company, illustrating the gems of the exhibition, and we must say that these plates are among the best photo-mechanical results that have come to our notice from England,—or would the imprint indicate that they were "made in Germany"? However, no matter where they are produced, it certainly reverts to the credit of the Royal Photographic Society that they have issued so superb a supplement. Every plate is a study for the progressive photographer. There is a richness of color seldom met with in English reproductions.

Optische Anstalt. C. P. Goerz, Berlin, Schoenberg.—A pamphlet of one hundred and fifty-nine pages, illustrating the products, methods, apparatus and establishment of C. P. Goerz, the well-known maker of the Goerz lenses.

Photographic Scissors and Paste.

Odd Breaks of Speech.—A coroner's jury in Maine reported that "deceased came to his death by excessive drinking, producing poplexy in the minds of the jury."

An old French lawyer, writing of an estate he had just bought, added: "There is a chapel upon it in which my wife and I wish to be buried, if God spares our lives."

On a tombstone in Indiana is the following inscription: "This monument was erected to the memory of John Jinkins, accidentally shot as a mark of affection by his brother."

A Michigan editor received some verses not long ago with the following note of explanation: "These lines were written fifty years ago by one who has, for a long time, slept in his grave merely for pastime."

A certain politician, lately condemning the Government for its policy concerning the income tax, is reported to have said: "They'll keep cutting the wool off the sheep that lays the golden eggs until they pump it dry."

An orator at one of the university unions bore off the palm when he declared that "the British lion, whether it is roaming the deserts of India or climbing the forests of Canada, will not draw in its horns nor retire into its shell."

A reporter in describing the murder of a man named Jorkin said: "The murderer was evidently in quest of money, but, luckily, Mr. Jorkin had deposited all his funds in the bank the day before, so that he lost nothing but his life."

A merchant who died suddenly left in his bureau a letter to one of his correspondents which he had not sealed. His clerk, seeing it necessary to send the letter, wrote at the bottom, "Since writing the above I have died."

An Oklahoma editor expresses his thanks for a basket of oranges thus: "We have received a basket of oranges from our friend, Gus Bradley, for which he will please accept our compliments, some of which are nearly six inches in diameter."

The *Morning Post* in 1812 made the following statement: "We congratulate ourselves most on having torn off Cobbett's mask and revealed his cloven foot. It was high time that the hydra-head of faction should be soundly rapped over the knuckles."

An English lecturer on chemistry said: "One drop of this poison on the tongue of a cat is sufficient to kill the strongest man," and an English lieutenant said that the Royal Niger Company wished to kill him to prevent his going up the river until next year.

A clergyman in an Eastern town warned his hearers lately "not to walk in a slippery path, lest they be sucked, maelstrom-like, into its meshes!" This metaphor suggests that of another clergyman who prayed that the word might be as a nail driven in a sure place, sending its roots downward and its branches upward.

The present Duke of Leeds is reported to have accused the late Government of making a direct attack on the brewers by means of a side wind. It was during the late administration that one of the Irish whips telegraphed to Dublin that "the silence of the Irish members would be heard in the House of Commons no longer."

It was the celebrated Sergeant Arabin, who, at the Central Criminal Court, informed the prisoner before him that "If there was a clearer case of a man robbing his master that case was this case;" and, after passing sentence, concluded, "I therefore give you the opportunity of redeeming a character irretrievably lost."

In the Irish House of Commons of 1795, during a debate on the leather tax, the Chancellor of the Exchequer, Sir John Parnell, observed that "in the prosecution of the present war every one ought to be ready to give his last guinea to save the remainder of his fortune." Mr. Vandeleur replied that "a tax on leather would press very heavily on the barefooted peasantry of Ireland."

At a recent temperance gathering an orator exclaimed: "The glorious work will never be accomplished until the good ship Temperance shall sail from one end of the land to the other, and with a cry of 'Victory!' at each step she takes, shall plant her banner in every city, town and village of the United States." Another speaker said that "All along the untrodden paths of the future we can see the hidden footprints of an unseen hand." "We pursue the shadow, the bubble bursts and leaves the ashes in our hands!"

The Discoverer of Zinc Etching.—The *American Art Printer* gives the following interesting note on this subject, that photo-zinc etching and photo-lithography, in so very many ways the same thing, were invented by two different men at almost the same time, the one being in England, the other nearly on the opposite side of the globe, in Melbourne, Australia. It was in the year 1859 that Mr. Osborn, of the Survey Department of Australia, sent a young man to England

to confer with Sir Henry James about the new Australian method of reproducing and making printing plates for publication. Sir Henry James was surprised that the method was so very much like his own invention, which he made — nearly — by accident, and he showed the young man some very good prints, and told him the story of how he came to invent this great medium of modern reproduction.

According to a book on zinc etching, published in 1862 by A. D. C. Scott, Sir Henry James was visiting friends at Ryde, on the Isle of Wight, and made the acquaintance of a young lady artist who had great skill and talent in copper etching. She mentioned to Sir Henry James that it would be of great advantage to the public if there could be a way of producing art subjects in a cheaper manner than that of copper etching or steel engraving. That idea aroused in Sir Henry James the desire of finding some means of duplicating the etching made originally by the artist, so that prints might be obtained in quantity. After trying several methods of fixing a picture on a metal plate, he tried to make a print on chromo-carbon paper, which process was used at that time (1859) in photography. He prepared the paper, printed a picture on it, then inked it in and developed it, and obtained a very nice copy, which he tranferred to a sheet of zinc. He further prepared and etched it, and his pleasure knew no bounds at the satisfactory result he attained in etching his plate deep enough to print many thousand copies from it. He began to improve his method day by day, and in a short time he found himself overworked on reproducing old manuscripts and masterpieces of ancient art. Handwriting of Edward I., and the great Doomsday Book, written in the year 1086, at Winchester, were among the first great works of reproduction by this invention. Day after day new treasures of art of long-forgotten masters, authors, and celebrities came to light, and brought refinement and education to mankind.

If you want to succeed in the world, you must make your own opportunities as you go on. The man who waits for some seventh wave to toss him on the dry land will find that the seventh wave is a long time coming. You can commit no greater folly than to sit by the roadside until some one comes along and invites you to ride with him to wealth or influence.—*John B. Gough.*

Microscopists say that the strongest microscopes do not, probably, reveal the lowest stages of animal life.

In the Twilight Hour.

MAN grows as higher grows his aim.

FORGIVENESS—The odor which flowers yield when trampled upon.

A GOOD sermon is half preacher's brain and half listener's ears.—*Golden Rule.*

IT takes a good deal of grace to be a good Christian with a big income.—*Ram's Horn.*

THE highest priced property on earth is that which costs a man his soul to get.
—*Ram's Horn.*

BABIES are the best company and the pleasantest playfellows in the world.
—*Charles Kingsley.*

GIVING money that you have taken out of your neighbor's pocket is never entered to your credit in the books of heaven.

THE reason so many people hold themselves in such high esteem, is that they compare themselves at their best with other people at their worst.

SATAN would smash every mirror in existence if he had a chance; there is nothing that he so much dreads as to have a man get a good look at himself.

IT is just as much the duty of some men to make money as it is of others to preach the gospel. Both will be held equally accountable for the use they make of their talents.

LITTLE self-denials, little honesties, little passing words of sympathy, little nameless acts of kindness, little silent victories over favorite temptations—these are the silent threads of gold which, when woven together, gleam out so brightly in the pattern of life that God approves.
—*F. W. Farrar, D D*

EXISTING oxen have descended from ancestral oxen.

LOVE always has in its heart the seeds of new sacrifice.—*Rev. Josiah Strong.*

THE rusty lock creaks the loudest, and the do-nothings make the most noise in the meeting.

A FRIEND sharing my sorrow takes away half its weight; sharing my joy, he makes it double.—*Taylor.*

"YE are the light of the world." Matt. 5; 14. Poor world! What a faint light it receives from most Christians!—*Moody.*

DUTY is the grandest idea, because it implies the idea of God, of the soul, of liberty, of responsibility, of immortality.
—*Lacordaire.*

THE vessel that can sink lowest without danger can carry the most freight; thus the heart that receives most grace, sinks lowest in its own esteem.

THE air with God's sweetness and tenderest sun ine in it, was meet for mankind to breathe into their hearts and send forth again as the utterance of prayer.
—*Hawthorne.*

IT would lessen very much the severity with which men judge of each other if they would but trace effects to their causes, and observe the progress of things in the moral as accurately as in the physical world.

So called trifles are often turning points in the affairs of men and the fate of nations. The tear of a babe touched the heart of a princess, turned aside the wrath of Pharaoh, created a nation out of serfs, and gave the world a mighty literature which lives and molds human thought after more than three thousand years.